

# VANDERBILT UNIVERSITY



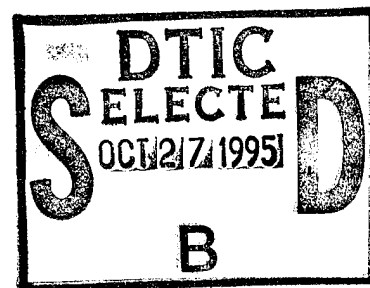
NASHVILLE, TENNESSEE 37235

TELEPHONE (615) 322-7311

*Free-Electron Laser Center for Biomedical and Materials Research • Direct phone 343-6146*

March 8, 1995

Michael Marron, Ph.D.  
Office of Naval Research  
Code 341  
800 North Quincy Street  
Arlington, VA 22217-5000



Re: Final Report for Contract # N00014-91-C-0084

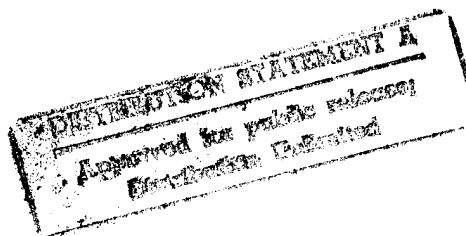
Dear Mike:

Enclosed is our final report for our contract entitled "Center for Medical and Materials Research with Free-Electron Laser" for the period 15 September 1991 to 31 December 1994. The format for our report is as follows: technical report on FEL machine operations, statements of progress from the local users community, and statements of progress from external users. Please let us know if you need further information.

All of us look forward to our future successes with Free-Electron Lasers.

Very truly yours,

Charles A. Brau, Ph.D.  
Director, Vanderbilt FEL Center



Enclosures

cc: C.C. Everly, Administrative Officer  
Director, NRL  
Defense Technical Information Center

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## FEL Operations

During the period of this contract the Vanderbilt FEL emerged as a reliable source of radiation for applications research. From April 1992 to June 1993 the FEL had its first "golden era," providing 2200 hours for applications research. The advances achieved with this beam time are summarized by the users in following sections of this report. In June 1993 the FEL began a planned shutdown to begin implementation of the Compton X-ray and other upgrades. This shutdown period extended longer than planned due to an unfortunate series of component failures. We now have a substantially more aggressive approach to insure reliable operation; for example, maintaining spare parts and more rapidly responding to component failures. Consequently, we have provided 281 hours from 16 May 1994 to the end of 1994 and 443 hours of beam time from 11 January 1995 through 8 March 1995. We believe the 1995 operation signifies the beginning of our second "golden era" at the Vanderbilt FEL Center. We have recently extended the operating day from 7 a.m. to midnight, 4-1/2 to 5 days per week, reflecting that we have indeed achieved routine operation.

In addition to providing more beam time, we have also steadily improved beam performance over the period of this contract. The dielectric-mirror optical cavity design has proven successful with operation from 2.0 to 9.5 microns. The intensity of the delivered beam is much higher at the focus due to improved optical quality, but it should be noted that the total output power (about 120 mJ/macropulse) remains somewhat less than that provided by the previous cavity design (200 mJ/macropulse). Currently we are investigating possible cause(s), in particular an instability in the turn-on of the electron beam.

In summary, the Vanderbilt FEL Center has evolved in a number of ways during the period of this contract. In the early stages it took a concentrated effort to complete the installation of the SLS FEL and achieve lasing. We then rapidly became a reliable source of infrared radiation for applications research and took on the challenge of the Compton X-ray project. More recently we have improved our ability to respond to problems that must be viewed as typical for an instrument as complex as the FEL, providing a more reliable beam for the users community.

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TO: OFFICE OF NAVAL RESEARCH  
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1. Reference: DoD Directive 5230.24, Distribution Statements on Technical Documents, 18 Mar 87.

2. The Defense Technical Information Center received the enclosed report (referenced below) which is not marked in accordance with the above reference.

FINAL REPORT  
N00014-91-C-0084  
TITLE: CENTER FOR MEDICAL AND  
MATERIALS RESEARCH WITH  
FREE-ELECTRON LASER

3. We request the appropriate distribution statement be assigned and the report returned to DTIC within 5 working days.

4. Approved distribution statements are listed on the reverse of this letter. If you have any questions regarding these statements, call DTIC's Cataloging Branch, (703) 274-6837.

FOR THE ADMINISTRATOR:

1 Encl

GOPALAKRISHNAN NAIR  
Chief, Cataloging Branch

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The cited documents has been reviewed by competent authority and the following distribution statement is  
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A  
(Statement)

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DEPUTY DIRECTOR  
CORPORATE PROGRAMS OFFICE

Debra T. Hughes  
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